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ENTOMOLOGICAL NEWS

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Notes on the Nesting Behavior of Plenoculus davisi Fox (Hymenoptera: Sphecidae)

HOWARD E. EVANS, Museum of Comparative Zoology, Cambridge, Mass.

The genus *Plenoculus* includes some of our smallest digger wasps, females usually measuring about five or six millimeters in length. In a recent revision of the genus, Williams (1960) has reviewed what is known of the biology of members of the genus. Of the fifteen North American species, two are known to prey upon Hemiptera (*davisi, stygius*), while a third (*cockerellii*) apparently preys upon pyralid caterpillars. Nothing is known regarding the other twelve species. Williams' (1914) report on *apicalis* (= *d. davisi*) contains the only available information on nest structure and provisioning behavior, but this report leaves several questions unanswered.

My acquaintance with this genus is limited to the most common and widely distributed form, *d. davisi* Fox. A few years ago I attempted to collect larvae of this form for inclusion in a survey of the structure of sphecid larvae. After several failures, I finally obtained one full-grown larva which has since been described (Evans 1959). The notes gathered in the course of these studies appear to add several details to what is known of the behavior of the species and are therefore summarized here. One field note was made in Grant Co., Kansas, in August 1952, two at Ithaca, N. Y., July and August 1953 and 1957, and six others at Granby Center, Oswego Co., N. Y., June–August 1955–58. I am indebted to F. X. Williams for identifying the *Plenoculus* and to D. M. Weisman for determining the hemipterous prey.

Plenoculus d. davisi nests in small sand pits, blow-outs, washes, and other places where there is flat or slightly sloping open sand or sandy gravel. Usually I have found only one or two at a time, but at Granby Center there were many females nesting, though the nests were widely scattered over the available sand. Nests are ordinarily dug in the morning, provisioned throughout the day, then closed in the late afternoon. About two hours of intermittent digging are required to complete a nest. The female kicks sand vigorously with the front legs while the abdomen moves up and down rapidly in synchrony with the front legs. Once finished, the nest is left open at all times until provisioning is complete. The small mound of sand that accumulates at the entrance remains intact until time of the final closure.

Several nests dug out at Granby Center, N. Y., entered the ground at about a 30–45 degree angle with the surface, then after 1–2 cm became vertical or nearly so, terminating in a cell at a depth of 4–7 cm. In the one nest dug out at Ithaca, the burrow was straight, forming about a 60 degree angle with the surface; the burrow was 7 cm long and terminated in a cell at a vertical depth of 5.5 cm. All of these nests had but a single cell. However, my studies were not sufficiently detailed so that I could be sure that unicellular nests are always the rule in these areas. All successful excavations were made before the nests had received the final closure, as it proved very difficult to dig out these very small nests once the burrow had been filled with sand. The diameter of the burrow was only about 1.5 mm, the cells only about 4 mm in diameter.

The one nest dug out in Grant Co., Kansas, had an oblique burrow which formed about a 45 degree angle with the surface; it was about 5 cm long, at a depth of 3.5 cm terminating in a cell. Beyond this cell I found three additional cells in more or less a straight line, all about 5 cm below the surface and from 1 to 2.5 cm apart. The burrow connecting these cells had been filled, but the burrow leading from the surface to the newest cell was still open. The female had been seen digging this nest in the morning; when it was dug out at 5 PM the three

completed cells each contained an egg. Williams (1914) found several cells per nest in Phillips Co., Kansas. In this case some of the cells contained partially grown larvae, indicating that the wasp had remained with the same nest over a period of several days.

TABLE 1.—Contents of nests of *Plenoculus d. davisi*

Nest no.	Locality	*Lygus lineolaris* nymphs	*Lygus lineolaris* adults	*Chlamydatus associatus* adults	*Trigonotylus ruficornis* adults
107, cell 1	Grant Co., Kansas	3			
107, cell 2		5			
107, cell 3		3			
107, cell 4		4			
592	Ithaca, N. Y.	2	1		
1552	Oswego Co., N. Y.	1	2		
1580A	Oswego Co., N. Y.	5		2	
1580B	Oswego Co., N. Y.	3	2		
1580C	Oswego Co., N. Y.				8

Williams found the nests to be provisioned with a single species of Miridae (probably *Psallus seriatus* Reuter), both adults and immatures. However, he cites one record of a burrow provisioned with immature aphids (Williams 1960). In the three localities in which I studied this wasp, Miridae were used exclusively, both adults and immatures. Any one nest tended to be provisioned with only one species, but there were some exceptions. In all, four quite different-looking mirids were employed. These were: *Lygus lineolaris* (P. de B.), *Phytocoris quercicola* Knight, *Trigonotylus ruficornis* (Goeffroy), and *Chlamydatus associatus* (Uhler). From three to eight bugs were used per cell (see accompanying table). In addition to those bugs taken from cells and recorded in the table, several more specimens of *Lygus lineolaris* and one specimen of *Phytocoris quercicola* were taken from wasps captured on the wing.

The bugs are carried to the nest in flight, the wasp grasping the beak of the bug very firmly in the mandibles (the wasps often retain their grasp on the bug even after being killed in cyanide). In flight, the bug is also embraced by the legs of the wasp; the bug is always venter-up. The wasp may land one

or more times on the sand with the prey before arriving at the open nest entrance and plunging quickly in. Bugs may be brought in rather rapidly, one every few minutes, or at much more widely spaced intervals; in any case the wasp usually remains inside the nest only a few seconds.

In the cell, the bugs are placed venter-up, head-in. Oviposition does not occur until the last bug is in place. The egg is whitish, about 1.5 mm long, curved only slightly. It is laid on the venter of the top bug, one end glued to the body just in front of one of the middle coxae, the rest of the egg extending free, off to one side at a right angle to the long axis of the bug. The egg hatches in two days and the larva begins feeding through the coxal cavity, its body at first remaining more or less perpendicular to that of the bug. Williams (1914, fig. 120) figures the small larva feeding, and my observations confirm his on this point. The one larva that was brought to maturity in a rearing tin required seven days from the time of hatching.

Collecting and nesting records from both New York and Kansas indicate that this wasp has at least two generations a year in both areas. There remain several unsatisfactorily resolved problems regarding this species. In particular, more information is needed on the number of cells per nest and whether or not the female makes a new nest every day or may add cells to an old one. Since Williams experienced some difficulty in excavating his nests, it is not absolutely certain that the cell which he found containing a feeding larva actually belonged to the nest he was digging. *Plenoculus davisi* is a difficult wasp to work with, chiefly because of its small size and the ease with which the inconspicuous nests can be accidentally destroyed.

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Three New Nearctic Acalypterate Diptera

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Frequently, a revision of a genus of insects is hardly published before undescribed species are discovered. Three such species are described here, with notes placing them in the recently published keys. Two are in the family Milichiidae, and one in Trixoscelidae.

MILICHIIDAE

Meoneura californica, new species

Highly polished black, with yellow halter knob, lightly browned wing, and two pairs of dorsocentral bristles.

Male.—Predominantly black; anterior half of front reddish yellow, parafacial and cheek anteriorly reddish brown; knob of halter lemon-yellow, the stalk brown; veins brown, the wing membrane lightly brown tinted.

Front shining, the frontal triangle poorly distinguished, especially toward apex, not smooth and polished as in *M. polita* Sabrosky, half as long as the front and with similar minute wrinkling; ocellar tubercle obscurely gray pollinose, subshining; eye large, rounded; cheek shining but not smooth, minutely wrinkled both above and below the diagonal ridge, rather broad, height at the middle 0.44 times that of an eye; middle bristle of the three on the vibrissal angle slightly shorter than the others; chaetotaxy of head as usual in the genus, the bristles moderately strong; postvertical bristles slightly divergent; one pair of anterior interfrontal bristles fairly strong and distinct, directed forward above the lunule.

Mesonotum, scutellum, and part of pleuron (pro-, meso-, and sternopleuron) polished; notal hairs sparse, as in *polita,* but not as long and conspicuous as in that species; two pairs of dorsocentral bristles, the posterior pair long and well developed, the presutural pair only about half as long, but clearly standing out

from the mesonotal hairs, especially as seen in profile; pteropleuron without bristles.

Abdomen shining, the dorsum finely shagreened, terga with minute hairs, appearing bare except under high magnification; terminalia (Fig. 1) with both forceps and lamella well developed, the latter with numerous long bristles.

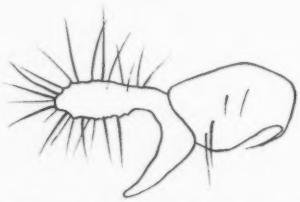

FIG. 1. Male terminalia of *Meoneura californica.*

Legs short, the basitarsi moderately short; fore femur with a strong preapical posteroventral bristle on distal fourth, followed by short hairs.

Venation as usual for the genus; costa beyond first vein with the usual short, regular setae; costa, third, and fifth veins strong, second vein slender but distinct, the fourth pale and weak; second vein bisinuate, shorter than in *polita,* the second costal sector (between apices of veins 1 and 2) 3.7 times the length of third sector, the third subequal to or barely longer than (1.05) the fourth sector; fourth vein weakly sinuate.

Female.—As described for male, except for terminalia.

Length of body, 1.5 mm; of wing, 1.25 mm.

Holotype male, *allotype,* and one male, five female paratypes, Borrego Valley, San Diego Co., CALIF., June 20, 1960, and one female paratype, Borrego Springs, Calif., January, 1961 (Bryan T. Whitworth), taken in Tinkham trap with rotten egg bait. Type No. 65670 in the U. S. National Museum, paratypes returned to the Bureau of Vector Control, California Department of Public Health. Also two female paratypes, Coachella Valley, Calif., Dec. 18, 1929 and Dec. 9, 1930 (R. W. Burgess), previously included as paratypes of *M. polita* Sabrosky [U. S. Nat. Mus.].

The genus *Meoneura* was revised by Sabrosky (1959, Ann. Ent. Soc. Amer. 52: 17–26), with a key to 12 species. The present new species closely resembles *M. polita* Sabrosky and will key to that species, but differs as shown in the following couplet:

Frontal triangle distinct, smooth and polished, ¾ or more the length of front; second costal sector 2.4–2.7 times the length of third sector, the latter longer than fourth (1.1–1.27 times); veins yellowish and wing membrane whitish; male terminalia simple, the lamella undeveloped (Sabrosky, 1959, Fig. 3) ..... *M. polita* Sabr.

Frontal triangle poorly distinguished, subshining, minutely wrinkled, half as long as front; second costal sector distinctly longer than in *polita*, 3.7 times the length of third sector, the third and fourth subequal; veins brown and wing membrane brown tinted; male terminalia with lamella well developed (Fig. 1, herewith) ..... *M. californica*, n. sp.

Pholeomyia vockerothi, new species

Large species with four pairs of dorsocentral bristles, no outer verticals, a row of 3 mesopleural bristles, and silvery dorsum of abdomen.

Male.—Black to black-brown, dull, brownish-gray pollinose except for the brilliant silvery dorsum of abdominal segments 2 through 5; wing hyaline, veins pale brown and membrane light brown tinted; calypteres brown with brown fringe.

Front slightly wider that that of *indecora* (Loew), at the vertex subequal to eye width and 0.38 times the width of head, sides slightly converging anteriorly, at the lunule the front 0.26 times the head width; postvertical bristles almost parallel, weakly divergent; outer vertical bristles absent; lunular bristles weak; face weakly concave, gray pollinose but subshining; parafacial linear; cheek very narrow, sublinear directly below eye, slightly widening anteriorly to vibrissa; proboscis short.

Mesonotum with four pairs of dorsocentral bristles, the anterior bristle in each row, close to the mesonotal suture, only half the length of the following bristle; two pairs of well-developed postsutural acrosticals, on posterior slope of mesonotum, the

presuturals especially well developed; mesopleuron with three strong bristles in a single row. Abdomen broad and flat, twice the width of thorax, abdominal terga 2 through 4 each with one row of short, fine, black hairs near posterior margin; abdominal sterna narrow, the fourth and fifth sparsely beset with hairs; sternum 4 narrow as in *expansa* Aldrich; sternum 5 subtriangular, broadened distally.

Wing venation approximately as in *indecora;* costal excision only moderately deep, intermediate between *indecora* and *expansa,* 1.7 times the length of small crossvein.

Length of body, 5 mm; of wing, 4 mm.

Holotype male, Highlands, N. C., 3,800 ft, June 24, 1957 (J. R. Vockeroth), "at light during heavy rain." Type in the Canadian National Collection, Ottawa.

Pholeomyia vockerothi is characterized by an interesting combination of characters. As may be seen in my recent revision of the genus (Sabrosky, 1959, Ann. Ent. Soc. Amer. 52: 316–331), the new species belongs with the few species (*longiseta* Becker, *latifrons* Sabrosky, *indecora* (Loew), and *expansa* Aldrich) in which there are three to four pairs of dorsocentral bristles and parallel or subparallel postverticals. Three of the four species have the thorax and abdomen concolorous in both sexes, gray to brown-gray pollinose. The striking silvery abdomen of *vockerothi* obviously resembles that of the fourth species, *P. expansa,* known only from California. However, several characters of the new species correspond to those of the common and widespread *P. indecora,* notably the presence of only three mesopleural bristles, absence of outer verticals, and brown wing. In the depth of the costal excision, *vockerothi* is intermediate between *indecora* and *expansa,* and in width of cheek it is narrower than either.

The range of *vockerothi* may be extremely limited. It was collected in the area in western North Carolina that has a localized fauna with striking relationships to the distant fauna of the far western states (e.g., the acrocerid genus *Eulonchus*), and its apparent relationship to the Californian species *expansa* suggests that it may be one of these localized species.

The new species will pass to couplet 4 in the key by Sabrosky (1959), which can be modified as follows, using first those characters that are known to apply to both sexes in this genus, although females of both *expansa* and *vockerothi* are still unknown:

4. Mesopleuron with three bristles in a single row along posterior margin; wing brown tinted; male lacking outer verticals.....4a.
— Mesopleuron more heavily bristled, typically with seven bristles in two rows; wing whitish; male with long, strong outer verticals (Calif.).....*P. expansa* Ald.
4a. Cheek narrow, sublinear below eye; dorsum of male abdomen silvery except for narrow first tergum (N.C.).....*P. vockerothi*, n. sp.
— Cheek broad for the genus, slightly less than breadth of third antennal segment; thorax and abdomen concolorous in both sexes, gray to brown-gray pollinose (widespread, U. S. and Canada).....*P. indecora* (Loew).

TRIXOSCELIDAE

Spilochroa geminata, new species

Wing with numerous hyaline spots, and abdomen polished black.

Male, female.—Color, pollinosity, and habitus as in the common *ornata* (Johnson). Dull, gray to grayish brown; front yellow, especially anteriorly, the parafrontal, face, and cheek whitish and frontal triangle gray-brown; antenna yellow above, third segment black to brown below, especially on outer surface. Thorax gray with some inconspicuous brown markings; small brown spots about the bases of bristles and hairs. Abdomen polished black except for dull, brownish basal segment, and, in the male, the large, dull, finely brown pollinose terminalia. Legs yellow, fore femur slightly infuscated on outer side. Wing, except at base, brown with numerous hyaline spots; subcostal cell hyaline with central brown spot. Hairs and bristles black.

Anatomy and chaetotaxy as in *S. ornata,* the type-species. Wing venation as figured for *ornata* (Williston, 1908, Manual N. Amer. Diptera, ed. 3, p. 297); wing with pattern of hyaline

spots similar to *ornata,* but marginal cell with three large, evenly distributed, subquadrate spots, the median larger than either of others; submarginal and first posterior cells each with two spots close together, directly behind the large median spot in marginal cell, and discal cell with two large spots beyond level of small crossvein; spotting in other areas much like that of *ornata.*

Length of body and of wing, 2.5–3 mm.

Holotype male, and *allotype,* Buckeye, Maricopa Co., ARIZ., Jan. 18, 1961 (A. N. Villa). Type No. 65671 in the U. S. National Museum. Paratypes: 2 males, 6 females, same data as holotype; 2 females, same locality, Dec. 9, 1960 and Jan. 11, 1961; male, 3 miles s. of Cave Creek Postoffice, Maricopa Co., Ariz., June 1952, at light (H. K. Gloyd); male, 2 females, Avondale, Ariz., Dec. 6, 1960; 2 males, Tucson, Ariz., June 17, 1917 (J. M. Aldrich); male, Imuris, Sonora, Mexico, Apr. 16, 1952 (R. E. Ryckman). The 1960–61 specimens were collected in Steiner fruit fly traps.

A key to the four Nearctic species of *Spilochroa* was published by Wheeler (1955, Wasmann Jour. Biol. 13: 111–112). The new species will key to *S. polita* Malloch, both having a subcostal cell with dark spot centrally, and abdomen polished black. The new species has a more thickly spotted wing, with pairs of subquadrate spots as noted, in the submarginal, first posterior, and discal cells, whereas in *polita* there is only a single, small, rounded hyaline spot at each of the points mentioned and the wing thus appears predominantly brown. No males of *polita* are available for comparisons of the male terminalia.

A geographical separation from *polita* is possible, but present material is too limited to be sure. All known specimens of *polita* were collected in New Mexico and Texas, and those of the new species in Arizona and Sonora.

New Exotic Crane-Flies (Tipulidae: Diptera). Part IV

CHARLES P. ALEXANDER, Amherst, Massachusetts [1]

The preceding part under this general title was published in ENTOMOLOGICAL NEWS, 72: 113–121; 1961. At this time I am considering species of the genus *Hexatoma,* chiefly from various parts of India where they were taken by Dr. Fernand Schmid, and including two from the Philippines, where they were taken by Mr. Charles F. Clagg and Dr. Edward S. Ross. Except where indicated to the contrary, the types of the novelties are preserved in my personal collection of these flies.

Hexatoma (Eriocera) prolixa new species

Belongs to the *longicornis* group; size medium (wing under 10 mm); antennae of male elongate, approximately twice the length of the wing; general coloration gray, praescutum with three darker stripes; wings with R_{1+2} slightly longer than either R_2 or R_{2+3}.

♂. Length about 6–6.5 mm; wing 7.5–8 mm; antenna about 12–16 mm.

♀. Length about 7–8 mm; wing 7.5–9 mm; antenna about 1.3–1.5 mm.

Rostrum short, light brown, sparsely pruinose; palpi with proximal segments brown, terminal segment black. Antennae of male 6-segmented, elongate, approximately twice the length of the wing, dark brown; flagellar segments greatly lengthened, especially the terminal one; segments with a dense erect white pubescence, with very sparse larger emergence bristles that are very small on the basal segment, becoming longer and more delicate on the terminal one; antennae of female short, apparently 9-segmented, the segments gradually decreasing in length outwardly. Head gray, clearer laterally behind; vertical tubercle

[1] Contribution from the Entomological Laboratory, University of Massachusetts.

of male large, rounded, with an impressed line on either side; tubercle in female very reduced.

Pronotum dark brown. Mesonotum gray, praescutum with three brown stripes, the median one narrowed behind, in front vaguely divided by a darker capillary vitta; vestiture sparse, pale. Halteres with stem brownish yellow, knob dark brown. Legs with coxae dark brown; trochanters more yellowed, especially beneath; remainder of legs brownish black, femoral bases obscure yellow, more extensively so on the posterior legs. Wings weakly darkened; stigma oval, very slightly indicated; veins brown, the outer medial branches paler. Veins chiefly glabrous, beyond cord with abundant trichia on *R*, R_1, R_2, R_4 and a complete series on distal section of R_5; a few trichia on distal section of M_{1+2} in some cases; basal veins glabrous, including *Sc*. Venation: *Sc* long, Sc_1 ending opposite fork of *Rs* to shortly before level of *r–m*; R_2 subequal to R_{2+3}, both shorter than R_{1+2}; *m–cu* shortly beyond fork of *M*.

Abdomen chiefly blackened, sparsely pruinose to appear plumbeous. Ovipositor with fleshy valves, as in the group.

Habitat. INDIA (Kumaon). *Holotype:* ♂, Koti, Pauri Garhwal, 4,200 feet, August 30, 1958 (Fernand Schmid). *Allotopotype:* ♀, pinned with type. *Paratypes:* 1 ♂, Lingari, Pauri Garhwal, 4,400 feet, September 1, 1958; 1 ♀, Lohajang, Pauri Garhwal, 6,070 feet, August 21, 1958; 3 ♂♀, Maupata, Pauri Garhwal, 4,500 feet, September 2, 1958; 1 ♂, Wan, Pauri Garhwal, 7,880 feet, August 20, 1958; 1 ♂, Bilap, Almora, 5,500 feet, September 6, 1958 (Fernand Schmid).

Hexatoma (*Eriocera*) *prolixa* is distinguished from other regional members of the *longicornis* group by its small size and comparative shortness of the male antennae, which are only about twice the wing length.

Hexatoma (Eriocera) serena new species

Size medium (wing of female 10 mm); general coloration black, surface subnitidous; legs black, femoral bases broadly yellow; wings strongly darkened, base conspicuously light yel-

low; veins with abundant macrotrichia; R_{2+3+4} and R_{1+2} subequal, R_2 and R_{2+3} short, nearly equal, *m–cu* at or beyond midlength of M_{3+4}; abdomen black, genital segment orange, ovipositor with cerci very long and slender.

♀. Length about 12 mm; wing 10 mm; antenna about 1.2 mm.

Rostrum and palpi black. Antennae of female short, 7-segmented; first segment of flagellum enlarged at base, narrowed outwardly, with a few long setae, the longest exceeding one-half the length of segment; succeeding three segments progressively shorter, terminal segment long, more than twice the length of the penultimate. Head black.

Thorax uniformly black, surface subnitidous; praescutal and scutal setae long, black. Halteres blackish, base of stem orange. Legs with coxae black, trochanters brown, remainder of legs black, the femoral bases broadly yellow, slightly more extensively so on posterior legs where nearly the proximal half is included. Wings strongly darkened, especially along the veins, centers of the cells slightly paler; prearcular field conspicuously light yellow, proximal ends of cells *C* and *Sc* less evidently brightened; veins brown, paler in the yellow areas. Veins of outer two-thirds of wing with abundant macrotrichia, including also all of veins *Sc, R* and *M* and outer half of Cu_1 and *1st A;* a few trichia at extreme outer end of vein *2nd A*. Venation: Sc_1 nearly opposite fork of the long *Rs;* R_{2+3+4} and R_{1+2} subequal or the former a trifle longer; R_2 and R_{2+3} short, nearly equal; basal section of R_5 about one-half R_{2+3+4}; cell *1st* M_2 a little shorter than M_4; *m–cu* at or just beyond midlength of M_{3+4}; distal section of Cu_1 in longitudinal alignment with the basal section. Surface of wing of type showing loose hairs lying on but detached from the membrane.

Abdomen brownish black, without differentiated basal rings; genital shield orange. Ovipositor with long, very slender cerci.

Habitat. INDIA (Kerala). *Holotype:* ♀, Periyakanal, 5,000–5,500 feet, December 17, 1958 (Fernand Schmid).

From other generally similar medium-sized regional species of the subgenus the present fly is readily told by the body coloration, and by the pattern, venation and trichiation of the wings. Such species include *Hexatoma* (*Eriocera*) *anamalaiana* Alexander, *H.* (*E.*) *tacita* Alexander, and *H.* (*E.*) *politovertex* Alexander.

Hexatoma (Eriocera) phaeton new species

Size medium (wing of male 9.5 mm); general coloration of thorax polished black; legs black, femoral bases narrowly yellowed; wings strongly darkened, unpatterned; Sc_1 ending opposite fork of *Rs*, R_{2+3} about twice R_2, *cell 1st* M_2 long-rectangular, cell *2nd A* narrow; abdomen black, the basal segments obscure yellow.

♂. Length about 9 mm; wing 9.5 mm; antenna about 1.7 mm.

Rostrum very short, brownish black; palpi black. Antennae of male 7-segmented, black throughout; first flagellar segment nearly as long as the succeeding two combined, stouter, with relatively sparse coarse setae; antepenultimate segment subequal to the terminal one, both shorter than the penultimate. Head black, more or less pruinose above.

Pronotum brownish black. Mesonotum shiny black; praescutal setae small and very sparse. Pleura black, posterior sclerites and pleurotergite a trifle paler. Halteres light brown, apex of knob darker brown. Legs with coxae black; trochanters brownish yellow beneath, darker above; remainder of legs black, femoral bases narrowly yellowed. Wings strongly darkened, unpatterned, with no trace of stigmal darkening; a whitish streak in basal half of cell *1st A* adjoining the vein; veins brown, *Sc* and *R* more yellowed. Strong macrotrichia on most veins beyond cord, sparse on M_3, lacking on M_4, Cu_1 and both Anals; on *Sc* well distributed over the entire length; *R* with numerous microscopic setigerous punctures before the arculus, very small but more abundant near extreme base.

Venation: *Sc* moderately long, Sc_1 ending opposite fork of *Rs;* R_{2+3+4} and R_{1+2} subequal or the latter slightly longer, shorter than R_{2+3}, the latter about twice R_2; cell *1st* M_2 long-rectangular, slightly shorter than the distal section of M_{1+2}; *m–cu* about one-third its length beyond the fork of *M,* longer than the distal section of Cu_1 which is not bent markedly basad; cell *2nd A* narrow.

Abdomen black, sides of basal tergite and proximal third of the second obscure yellow, posterior borders of segments very narrowly pale; no differentiated basal rings; outer segments with conspicuous setae, long and yellow on the sternites, black and much shorter on the tergites.

Habitat. INDIA (Madras). *Holotype:* ♂, Kumili, 2,000–2,500 feet, November 28, 1958 (Fernand Schmid).

The most similar regional members of the subgenus include *Hexatoma* (*Eriocera*) *serena* new species and *H.* (*E.*) *rama* Alexander, all readily told among themselves by the body and wing coloration and by the venation and trichiation of the wings.

Hexatoma (Eriocera) furtiva new species

Size medium (wing of male about 12 mm); head and thorax black, pruinose; praescutum dark gray with four opaque black stripes that are narrowly bordered by more intense black; legs black; wings strongly tinged with brown, the prearcular and costal fields strongly so; outer radial veins with abundant macrotrichia; R_{1+2} long, cell M_1 present; abdomen black, segments two to four orange yellow.

♂. Length about 15 mm; wing 12.3 mm; antenna about 3 mm.

Rostrum and palpi black. Antennae of male 8-segmented, black; first flagellar segment shorter than the succeeding two combined; all flagellar segments with long setae, stouter on the more proximal segments. Head black, gray pruinose, with long coarse proclinate bristles; vertical tubercle porrect.

Pronotum black, sparsely pruinose. Mesonotal praescutum dark gray, with four opaque black stripes that are narrowly bordered by more intense black, including a central vitta; posterior sclerites black, subopaque; praescutum with abundant short black setae. Pleura dull black, pruinose. Halteres short, black. Legs with coxae and trochanters black, the former opaque, fore pair with abundant long setae; remainder of legs black; segments without scales. Wings strongly tinged with brown, the prearcular and costal fields strongly so, stigma not further differentiated; veins brown, outer veins behind the radial field paler and more delicate. Outer radial veins with abundant trichia, sparse or lacking on R_{2+3+4} and R_{2+3} present on both sections of R_5; scattered trichia on M_1, very sparse on M_2 and M_3. Venation: *Sc* long, Sc_1 ending opposite R_2, Sc_1 long, exceeding R_{2+3}; R_{1+2} very long, about four times R_2; cell M_1 present, subequal in length to its petiole; *m–cu* at near midlength of M_{3+4}; vein *2nd A* long and sinuous.

First abdominal segment dull black, segments two to four, inclusive, orange yellow, unpatterned except for vague lateral darkenings on segments three and four; basal rings not differentiated; segments five to nine, including hypopygium, intensely black, subnitidous.

Habitat. INDIA (Kumaon). *Holotype:* ♂, Rishikesh, Dehra Dun, 1,200 feet, March 25, 1958 (Fernand Schmid).

The most similar regional species is *Hexatoma* (*Eriocera*) *semilimpida* (Brunetti) which differs conspicuously in the pattern of the body and wings.

Hexatoma (Eriocera) apoensis new species

Belongs to the *rubrescens* group; mesonotum obscure orange, with two small brown lateral spots, pleura more yellowed with two further darkened areas; legs obscure yellow; wings brownish yellow, unpatterned except for the very small brown stigma; basal section of R_5 very reduced, cell M_1 present, subequal in length to its petiole, cell *1st* M_2 rectangular, with *m–cu* at near midlength; basal abdominal segments orange, the outer ones orange, hypopygium brownish yellow.

♂. Length about 8 mm; wing 11 mm; antenna about 1.8 mm.

Rostrum and palpi black. Antennae of male 8-segmented; scape and pedicel brownish yellow, flagellum light brown; first flagellar segment stout basally, narrowed on outer half, a little shorter than the succeeding two combined; segments two and three subequal, the former with very long verticils, the longest only a little shorter than the segments; outer three segments gradually decreasing in length. Head light gray, center of disk extensively infuscated; vertical tubercle low.

Pronotum orange, pretergites yellow. Mesonotal praescutum chiefly obscure orange, produced by four confluent stripes, humeral and lateral regions paler; a distinct brown spot on side of praescutum behind the pseudosutural foveae; posterior interspaces vaguely darkened; scutum obscure orange, with a darkened median area just behind the suture and a pair at ends of the latter; scutellum and postnotum paler brownish yellow; vestiture of notum exceedingly reduced. Pleura obscure yellow, with small darkened areas on anepisternum and before the wing root. Halteres infuscated. Legs with coxae and trochanters testaceous yellow; remainder of legs obscure yellow, outer tarsal segments weakly more darkened; legs with abundant linear scales, paler in color than the larger setae. Wings brownish yellow, unpatterned except for the very small darker brown stigma; veins brown. Veins delicate, with macrotrichia beyond cord and on outer two-thirds of *Rs*. Venation: *Rs* long, in longitudinal alignment with R_5, basal section of the latter very reduced; R_{2+3+4} a trifle longer than R_{1+2} or R_2; cell M_1 present, subequal in length to its petiole; cell *1st* M_2 rectangular, with *m–cu* at near midlength; cell *2nd A* relatively narrow.

Abdomen with basal three or four segments orange, outer segments brown, darker before the brownish hypopygium.

Habitat. PHILIPPINES (Mindanao). *Holotype:* ♂, Mount Apo, 6,000 feet, September 10, 1930 (C. F. Clagg).

Hexatoma (*Eriocera*) *apoensis* is most nearly related to *H.* (*E.*) *angustipennis* (Enderlein), of Sumatra, and *H.* (*E.*) *rubrescens* (Walker), of Borneo, differing in the coloration,

especially of the thorax. The elongate scales on the legs are found in all members of the *rubrescens* group that are known to me.

Hexatoma (Eriocera) rossiana new species

Size small (length, wing and antennae all about 8 mm); general coloration black, outer two abdominal segments orange; antennae of male 5-segmented, flagellar segments progressively shorter outwardly, provided with an abundant pale pubescence but without bristles; knobs of halteres whitened; wings strongly infuscated, veins beyond cord with abundant trichia; cell M_1 present, very deep; *m–cu* at near four-fifths the length of cell *1st* M_2.

♂. Length about 8 mm; wing 8 mm; antennae about 8.2 mm.

Rostrum relatively small, light brown; palpi brownish black. Antennae of male elongate, subequal to body or wing; scape ferruginous, remainder dark brown to brownish black; 5-segmented, there being only three very long flagellar segments that decrease gradually in length and diameter from the basal one outwardly; segments with a very abundant erect pale pubescence but without emergence bristles, as are common in most species of the genus having elongate antennae in the male sex. Head dull black, slightly patterned with paler on the inconspicuous slightly bifid vertical tubercle; sides of vertex and genae adjoining the eyes slightly pruinose.

Pronotal scutum dark brown, obscure yellow medially, scutellum similarly brightened. Mesonotal praescutum with the ground dull black, with four poorly indicated plumbeous stripes, the intermediate pair narrowly separated by a distance nearly equal to their own width; remainder of notum dull black, posterior border of mediotergite more pruinose; mesonotum unusually glabrous, the vestiture reduced to sparse erect scattered setae on the scutellum and praescutal interspaces. Pleura dull plumbeous black; membrane darkened. Halteres with stem dusky, base restrictedly obscure yellow, knob whitened. Legs black throughout, vestiture short and appressed. Wings very

strongly infuscated, somewhat more so on anterior half, stigma not differentiated; a whitened streak behind basal third of vein *1st A;* veins brown. Veins beyond cord with numerous macrotrichia, on *M* continued basad to about opposite origin of *Rs*. Venation: *Sc* long, Sc_1 ending beyond fork of R_{2+3+4}, Sc_2 far retracted; *Rs* long, slightly exceeding R_4; R_{2+3} a little shorter than R_{1+2}; cell M_1 present, about three times its petiole; cell *1st* M_2 elongate, with *m–cu* at near four-fifths its length.

Abdomen black, eighth and ninth segments orange; hypopygium very small and inconspicuous, provided with long pale setae.

Habitat. PHILIPPINES (Mindoro). *Holotype:* San Jose, April 5, 1945 (E. S. Ross); California Academy of Sciences.

This very distinct fly is named for its collector, Dr. Edward S. Ross, authority on the Embioptera and other groups of insects. In the very long *Rs,* which is about twice as long as *R,* the fly differs from all other described regional species. The reduction in number of antennal segments to five likewise is noteworthy. By Edwards's key to the Old World species of *Eriocera* (1921) the fly runs to couplet 35, disagreeing with all species beyond this point.

Mosquitoes: Key to United States Genera Based on Male Genitalia (Diptera, Culicidae)

HAROLD GEORGE SCOTT [1]

With the sustained interest in identification of Diptera via characteristics of the male genitalia (Fig. 1), simple keys to the various groups have become essential to efficient entomological instruction. The following key, devised for CDC training courses, has proven valuable in introducing this taxonomic method.

[1] Training Branch, Communicable Disease Center, Public Health Service, U. S. Department of Health, Education, and Welfare, Atlanta, Georgia.

The failure of *Aedes aegypti* to key out with other members of the genus (steps 2 and 12 of key), lends credence to the concept that this is an African species, only distantly related to Nearctic aedines.

1. Basistyle with 1–2 stout spines near base; phallosome 4 or more times as long as wide, often with leaflets at tip..... **Anopheles**
   Basistyle without basal spines; phallosome less than 4 times as long as wide, without leaflets at tip.....2
2. Claspettes present (absent in *Aedes aegypti*).....3
   Claspettes absent.....5
3. Dististyle strongly swollen (rarely lobate); *or* dististyle bowed inward; *or* both..... **Psorophora**
   Dististyle not strongly swollen; straight, or bowed outward.....4
4. Large leaf-like scales on distal lobe of basistyle..... **Haemogogus**
   Without large leaf-like scales on distal lobe of basistyle.... **Aedes**
5. Tenth sternite with comb of teeth or crowned with tuft of spines.....6
   Tenth sternite simple or with a few apical teeth.....7
6. Lobe of ninth tergite less than one-half as long as basistyle..... **Culex**
   Lobe of ninth tergite at least one-half as long as basistyle..... **Deinocerites**
7. Dististyle with 3 or more branches..... **Wyeomyia**
   Dististyle simple or with a single lobe near base.....8
8. Phallosome plate-like, with 1 or more large teeth on each side..... **Uranotaenia**
   Phallosome sub-conical, often with small teeth near tip....9
9. Basal lobe of basistyle with 1–2 rods at apex, few or no setae..... **Mansonia**
   Basal lobe of basistyle with spines, numerous small setae..10
10. Claw of dististyle comb-like..... **Orthopodomyia**
    Claw of dististyle spine-like.....11
11. Outer edge of basistyle with large scales.....12
    Outer edge of basistyle without large scales..... **Culiseta**
12. Dististyle cylindrical, with subapical spine.. **Toxorhynchites**
    Dististyle tapering, with apical spine..... **Aedes aegypti**

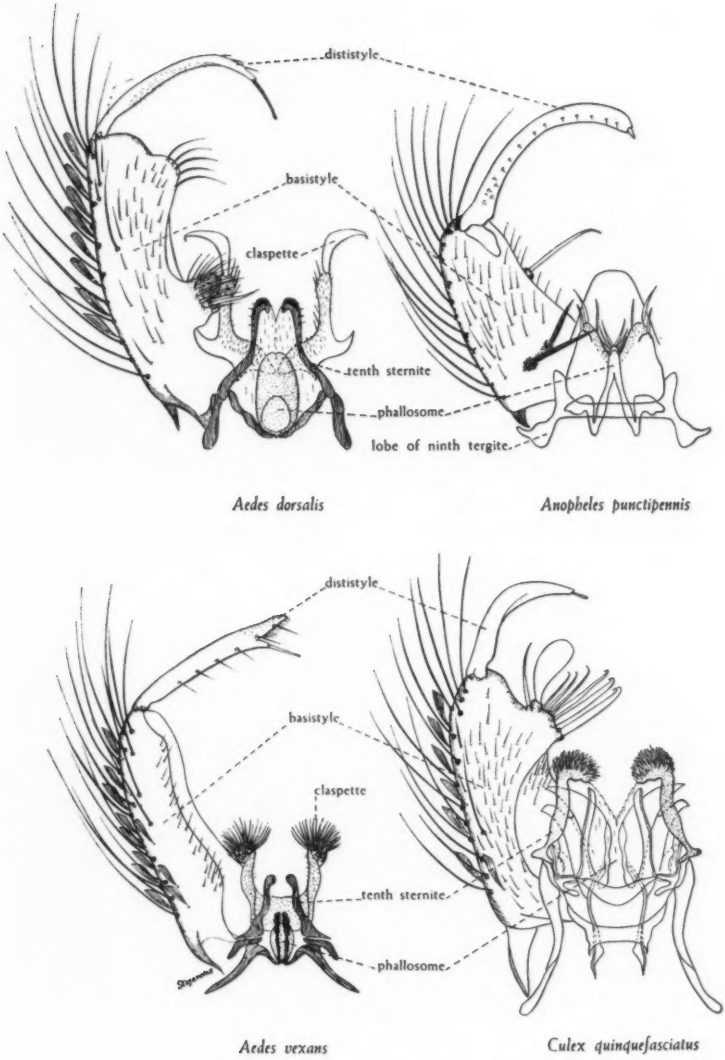

Fig. 1. MALE GENITALIA OF MOSQUITOES

An Unusual Habitat Niche for Ancistrocerus tigris tigris (Saussure) (Hymenoptera: Vespidae) [1]

HARRY C. COPPEL [2]

Field investigations on the introduced pine sawfly, *Diprion similis* (Htg.), in 1959 showed that approximately 10% of the cocoons from which adult sawflies had emerged were inhabited by various arthropods (Coppel, 1960). First generation cocoons are usually spun on the needles and branches of white pine trees. Though most of the inhabited cocoons were used by spiders, approximately 8% were observed with mud plugs covering the sawfly emergence holes (Fig. 1). These were placed singly in vials and incubated until emergence was complete. The adult wasps, all males, were determined as *Ancistrocerus tigris tigris* (Saussure) by K. V. Krombein of the U. S. National Museum, Washington, D. C. This species is indigenous to North America and is widespread in the United States and Southern Canada where it has been bred from twigs, oak galls, goldenrod galls, old wasp nests etc. Apparently, empty sawfly cocoons have not been observed as habitat niches previously, and females of the genus *Ancistrocerus,* in general, construct and provision a linear series of cells.

In 1960, a simple sandwich-type artificial nest was constructed (Fig. 2) to see whether females of *A. t. tigris* could be attracted to single cocoons in parallel. It consisted of two rows of cocoons, the upper one containing empty cocoons from which female sawflies had emerged and the lower one empty cocoons from which males had emerged. These were backed with cocoons in similar rows but in reverse placement (male cocoons above female cocoons), and were suspended approximately 6 feet above the ground, from branches of white pine trees. Though most of the nests were destroyed by vandals one remained which had been utilized by the wasp. Of its eleven

[1] Approved for publication by the Director of the Wisconsin Agricultural Experiment Station. This work was supported in part by the Wisconsin Conservation Department.

[2] Associate Professor, Department of Entomology, University of Wisconsin, Madison 6, Wisconsin.

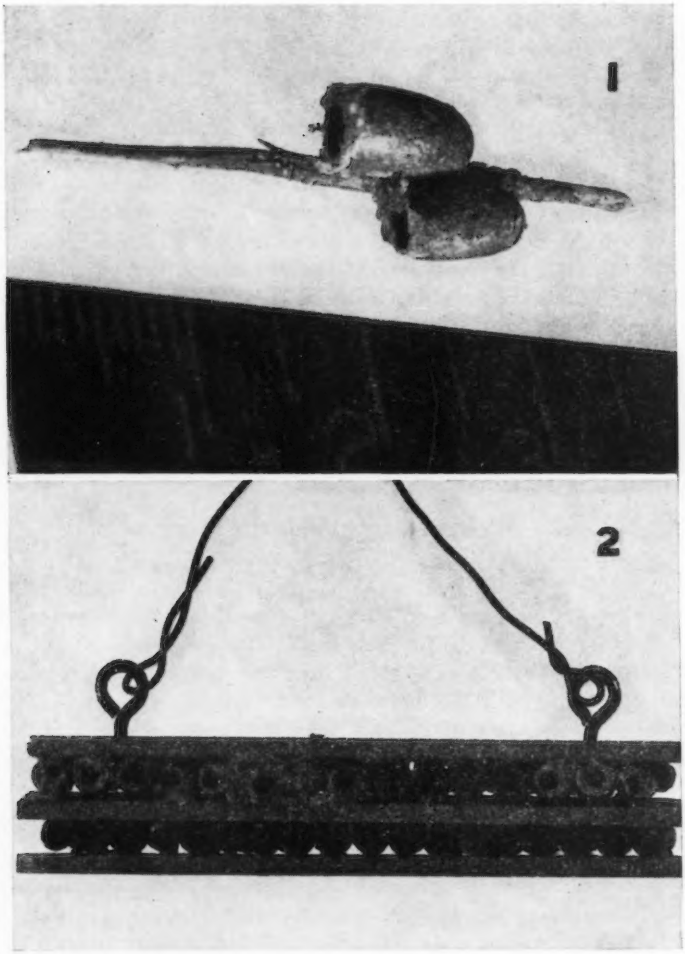

FIG. 1. Cocoons of *Diprion similis* (Htg.) on white pine twig, showing emergence holes of *Ancistrocerus tigris tigris* (Saussure) through mud plugs.

FIG. 2. Artificial nest used to attract *Ancistrocerus tigris tigris* (Saussure), showing preference for upper row of larger female sawfly cocoons.

mud-plugged cocoons ten produced adult wasps, of which four were males, four females, and two escaped. The only cocoons utilized were those from which female sawflies had emerged and whose emergence holes ranged from 3.2 to 3.6 mm in diameter.

Some wasp larvae in the cocoons were parasitized by insects in 1959. *Monodontomerus dentipes* (Dalm.) (Hymenoptera: Torymidae), an European parasite of *D. similis* larvae in cocoons was obtained as were two native ichneumonid parasites determined by Miss L. Walkley, U. S. National Museum, Washington, D. C., as *Agrothereutes lophyri* subsp. n., and Ephialtes sp. Apparently, the sawfly parasites *M. dentipes* and *A. lophyri,* which normally parasitize *D. similis* larvae in cocoons, also parasitize later occupants of the *Diprion* cocoons without discrimination.

REFERENCE

COPPEL, H. C. 1960. Ann. Ent. Soc. America 53: 847–849.

Collembola from Rodent Nests

D. L. WRAY [1] and G. F. KNOWLTON [2]

Springtail insects or Collembola are found in a large number of diverse habitats and probably in more unique places than any other animal group. The objective of this paper is to report on those species found in the course of studying several kinds of rodent nests. Materials from these nests were collected and run through Berlese funnels by G. F. Knowlton and his associates. The determinations and systematic arrangement were made by D. L. Wray.

1. POCKET GOPHER NESTS (*Thomomys talpoides*).

These were collected at Monte Cristo, Utah on July 18, 1951 by G. F. Knowlton and T. T. Tibbetts. The following five species were found in the nests:

[1] Entomologist, Div. of Entomology, Dept. of Agriculture, Raleigh, N. C.
[2] Utah State University, Logan, Utah.

Hypogastrura nivicola Fitch, 1 specimen; *Isotoma olivacea* Tullberg, numbering in the thousands; *Isotoma brucealla* Wray, 24; *Isotoma nigrifrons* Folsom, 20; and *Entomobrya purpurascens* Packard, 1.

2. Abandoned Mouse Nest.

Materials from this nest were collected at American Falls, Idaho, April 9, 1952 by G. F. Knowlton and J. V. Bruce.

The following seven species were found:

Hypogastrura armata Nicolet, in considerable numbers; *Hypogastrura promatro* Wray, few; *Folsomia guthriei* Linnaniemi, few; *Isotoma eunotabilis* Folsom, few; *Entomobrya nivalis* Linnaeus, few; *Lepidocyrtus cyaneus* Tullberg, f.p., few; *Pseudosinella octopunctata* Boerner, few.

3. Mouse Nest (*Microtus* sp.).

This nest was obtained at Hyde Park, Utah, June 29, 1950 by G. F. Knowlton and J. V. Bruce.

The following eight species were found, most in small numbers unless otherwise indicated:

Hypogastrura matura Folsom, considerable numbers; *Proisotoma aquae* Bacon, large numbers; *Isotoma minor* Schaeffer; *Isotoma eunotabilis* Folsom; *Lepidocyrtus cyaneus* Tullberg; *Pseudosinella sexoculata* Schött; *Pseudosinella alba* Packard; *Pseudosinella candida* Folsom.

4. Pack Rat Nests (*Neotoma cinerea*).

(A). Nests collected at Logan Cave, Logan Canyon, Utah on October 19, 1951 by G. F. Knowlton and W. H. Wilde yielded the following two species:

Agrenia bidenticulata Tullberg, fifteen specimens; and *Entomobrya marginata* Tullberg, two specimens with blunt ending mucro. Also found were a few mites, small beetles, dipterous larvae, and a small adult diptera.

(B). Nests collected at Logan Cave, Logan Canyon, Utah on November 18, 1951 by G. F. Knowlton yielded the following three species:

Folsomia fimetaria Linn., few; *Entomobrya nivalis* Linn., small numbers; and *Lepidocyrtus pusillus* Linn., small number.

(C). Nests collected at Logan Cave, Logan Canyon, Utah on November 17, 1951 by G. F. Knowlton and B. K. Collmar produced the following six species:

Tullbergia granulata Mills, 1 specimen; *Folsomia fimetaria* Linn., few; *Isotoma eunotabilis* Folsom, few; *Entomobrya marginata* Tullberg, few; *Entomobrya nivalis* Linn., few; and *Lepidocyrtus pusillus* Linn., few.

Summary

A summary of the number of species in each family that were found in rodent nests would be as follows:

Poduridae

Hypogastrura armata Nicolet, *H. nivicola* Fitch, *H. matura* Folsom, *H. promatro* Wray, *Tullbergia granulata* Mills.

Isotomidae

Poisotoma aquae Bacon, *Agrenia bidenticulata* Tullberg, *Folsomia guthriei* Linnaniemi, *F. fimetaria* Linnaeus, *Isotoma brucealla* Wray, *I. nigrifrons* Folsom, *I. eunotabilis* Folsom, *I. minor* Schaeffer, *I. olivacea* Tullberg.

Entomobryidae

Entomobrya purpurascens Packard, *E. nivalis* Linnaeus, *E. marginata* Tullberg, *Lepidocyrtus cyaneus* Tullberg, f.p., *L. pusillus* Linnaeus, *Pseudosinella sexoculata* Schött, *P. alba* Packard, *P. octopunctata* Boerner, *P. candida* Folsom.

Species belonging to the family Isotomidae were found more numerous than any in the other families. A total of 23 species belonging to 9 genera were found in the rodent nests examined.

Evidently the moisture condition was such as to be conducive for this wide range of species to live.

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Obituary

It is with deep regret that we here record the death, on August 23rd, of Dr. **Philip P. Calvert,** Professor Emeritus of the University of Pennsylvania and Editor Emeritus of ENTOMOLOGICAL NEWS. At the time the NEWS was founded he was on its advisory committee, then became Associate Editor in 1893, and was Editor from 1911 until 1944. It is hardly conceivable that the NEWS could have survived the vicissitudes of its 72 years without the steadfast guidance and devoted service of Dr. Calvert. A biographical memorial will appear in a later issue of this publication.

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Butterflies. Wish to exchange specimens for Japanese species. Please write to Ichiro Nakamura (Boy, age 16), 26 Aza-Nichiyama Obayashi Takarazuka-shi, Hyogo-Ken, Japan.

Phasmidae of nearctic area desired alive. Purchase or trade, drawing on large stock of major orders, worldwide. Domminck J. Pirone, Dept. Entomology, Cornell University, Ithaca, N. Y.

Nitidulidae and Rhizophagidae wanted in exchange for European beetles of all families. O. Marek, Zămberk 797, Czechoslovakia.

Wanted and Needed. We are compiling a history of entomology, and particularly, at present, of the amateur insect clubs that flourished 50 to 75 years ago. Will you who have knowledge of such early clubs or societies advise me, giving facts on the time of existence, members, etc., which you may have. J. J. Davis, Dept. of Entomology, Purdue University, Lafayette, Indiana.

Cockroaches (Blattoidea) of Japan, Okinawa, Formosa (Taiwan), and the Philippines are being studied in cooperation with Dr. K. Princis. Loans of specimens from that area are desired. A. B. Gurney, U. S. National Museum, Washington 25, D. C.

Orthoptera. Gryllinae (except domestic sp.) and **Pyrgomorphinae** of the world wanted in any quantity for work in morphology, taxonomy, cytology, and experimental biology; dry, or in fluid, or living. Write D. K. Kevan and R. S. Bigelow, Dept. of Entomology, McGill University, Macdonald College, Quebec, Canada.

Beetles of the world wanted, all species in exchange for American beetles, moths and butterflies. James K. Lawton (age 18), 7118 Grand Parkway, Wauwatosa 13, Wisconsin.

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